

<small>FORM PTO 1390 (REV 5-99) US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE</small>		<small>ATTORNEY DOCKET NUMBER 2001_0219A</small>
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. §371		<small>U.S. APPLICATION NO. (61120, 13277, FR 1) NEW</small> 09/786990
International Application No. PCT/JP00/04652	International Filing Date July 12, 2000	Priority Date Claimed July 16, 1999
Title of Invention SOUND REPRODUCTION APPARATUS		
Applicant(s) For DO/EO/US Masahide ONISHI and Fumiyasu KONNO		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. §371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. §371. 3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. §371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. §371(b) and PCT Articles 22 and 39(1). 4. <input type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. §371(c)(2)) a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau. Form PCT/IB/308 - Attachment "A" c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US) 6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. §371(c)(2)). -Attachment "B" 7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3)). a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19. 9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. §371(c)(4)). 10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. §371(c)(5)). Items 11. to 14. below concern other document(s) or information included: 11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. -Attachment "D" 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. - Attachment "E" <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 14. <input checked="" type="checkbox"/> Other items or information: <u>Unexecuted Declaration and Power of Attorney along with cover letter</u> - Attachment "C" Form PCT/IB/304 - Attachment "F"		

U.S. APPLICATION NO. (if known) 09/786990	INTERNATIONAL APPLICATION NO. PCT/JP00/04652	ATTORNEY'S DOCKET NO. 2001_0219A
15. [X] The following fees are submitted		CALCULATIONS PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee nor international search fee paid to USPTO and International Search Report not prepared by the EPO or JPO \$1000.00 International Search Report has been prepared by the EPO or JPO \$ 860.00 International preliminary examination fee not paid at USPTO but international search paid to USPTO \$ 710.00 International preliminary examination fee paid to USPTO but claims did not satisfy provisions of PCT Article 33(1)-(4) \$ 690.00 International preliminary examination fee paid at USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$ 100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =		\$860.00
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		
Claims	Number Filed	Number Extra
Total Claims	12 -20 =	-0-
Independent Claims	1 - 3 =	-0-
Multiple dependent claim(s) (if applicable)		+ \$270.00
TOTAL OF ABOVE CALCULATIONS =		\$860.00
<input type="checkbox"/> Small Entity Status is hereby asserted. Above fees are reduced by 1/2.		
SUBTOTAL =		\$860.00
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).		
TOTAL NATIONAL FEE =		\$860.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40 per property +		
TOTAL FEES ENCLOSED =		\$860.00
		Amount to be refunded \$
		Amount to be charged \$

- a. A check in the amount of \$860.00 to cover the above fees is enclosed. A duplicate copy of this form is enclosed.
- b. Please charge my Deposit Account No. 23-0975 in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 23-0975.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

19. CORRESPONDENCE ADDRESS



000513
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By: 

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March 13, 2001

[CHECK NO. 43463]

[2001_0219A]

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :
Masahide ONISHI et al. : Attn: BOX PCT
Serial No. NEW : Docket No. 2001_0219A
Filed March 13, 2001 :
SOUND REPRODUCTION APPARATUS
[Corresponding to PCT/JP00/04652
Filed July 12, 2000] :
THE COMMISSIONER IS AUTHORIZED
TO CHARGE ANY DEFICIENCY IN THE
FEE FOR THIS PAPER TO DEPOSIT
ACCOUNT NO. 23-0975.

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

Prior to the initial examination for the above-identified PCT application, kindly amend the application as follows:

IN THE CLAIMS:

Kindly amend claim 3 as follows:

3.(Amended) The sound reproduction apparatus recited in claim 1, wherein the sound filter is a primary high-pass filter.

Kindly add the following new claim:

12.(NEW) The sound reproduction apparatus recited in claim 2, wherein the sound filter is a primary high-pass filter.

REMARKS

The present Preliminary Amendment is submitted to delete the multiple dependency of claim 3, thereby placing such claims in condition for examination and reducing the required PTO filing fee.

Copies of the amended portion of the claim with changes marked therein is attached and entitled "*Version with Markings to Show Changes Made.*"

Respectfully submitted,

Masahide ONISHI et al.

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March 13, 2001

CLAIMS

1. A sound reproduction apparatus comprising:
 - a power amplifier for amplifying input signal;
 - a speaker unit for reproducing output signal of the power amplifier,
- 5 mounted on a baffle;
 - a first microphone provided outside a dust cap of speaker unit;
 - a second microphone provided inside the dust cap of speaker unit;
 - a first filter that receives output signal of said first microphone containing ambient noise and reproduced signal of said speaker unit, and
- 10 outputs a signal of certain specific pass band;
 - a second filter that receives output signal of said second microphone, and outputs a signal of certain specific pass band;
 - an adder for adding output signals from said first filter and said second filter;
- 15 conversion means for converting AC signal from the adder into DC signal; and
 - control means provided at the input stage of said power amplifier, said control means automatically controlling the strength of said input signal in accordance with DC signal delivered from said conversion means
- 20 so that the sound reproduced by said speaker unit is not masked by ambient noise around said speaker unit.

2. The sound reproduction apparatus of claim 1, wherein the first filter is a primary low-pass filter.

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3. The sound reproduction apparatus recited in claim 1 or claim 2, wherein the second filter is a primary high-pass filter.

4. The sound reproduction apparatus of claim 1, wherein the first

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JC02 Rec'd PCT/PTO 13 MAR 2001

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SOUND REPRODUCTION APPARATUS

TECHINCAL FIELD

5 The present invention relates to a sound reproduction apparatus that provides favorable reproduced signals in an environment of relatively high ambient noise.

BACKGROUND ART

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FIG. 6 is block diagram of a conventional sound reproduction apparatus. Referring to FIG. 6, signals supplied to input terminal 1 is led, through a variable gain controller 2, to a power amplifier 3 for power amplification. Output signal from the power amplifier 3 is delivered to a speaker unit 4 mounted on a baffle 5 to be reproduced into sounds. Meanwhile, a microphone 6 placed at the vicinity of the speaker unit 4 collects a sum of the signals radiated from the speaker unit 4 and the noise in the neighborhood of the baffle 5.

15 Output signal from the microphone 6 is delivered, together with output signal of the power amplifier, to a subtracter 7. The subtracter 7 subtracts input signal components from the sum of the signals radiated from the speaker unit 4 and the ambient noise collected by the microphone 6, in order to extract the ambient noise components. Output signal of the subtracter 7, which is proportional to the ambient noise, is limited to a pass band by a low-pass filter 8. An output signal of the low-pass filter 8 is 20 rectified from AC to DC by a rectifier 9 and then delivered to the variable gain controller 2 provided at the front stage of the power amplifier 3. Thus, degree of amplifying the input signals is automatically varied by the 25 variable gain controller 2 in accordance with a degree of ambient noise

around the speaker unit 4, so that signals radiated from the speaker unit 4 is not masked by the ambient noise.

In the conventional sound reproduction apparatus, however, there is a difference between the signal components radiated from the speaker unit 4 and the signal components delivered from the power amplifier 3. Therefore, the subtracter 7 can not totally remove the signal components radiated from the speaker unit 4, or, it is difficult to extract component of the ambient noise around the speaker unit 4. So, it is compelled to perform the control, using only a very limited pass band components of the noise.

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DISCLOSURE OF THE INVENTION

The present invention aims to provide a sound reproduction apparatus that precisely removes signals radiated from a speaker unit and varies the gains in accordance with the ambient noise.

A sound reproduction apparatus of the present invention extracts ambient noise components using a first microphone provided outside the dust cap of a speaker unit and a second microphone provided inside the dust cap of the speaker unit. With the above described arrangement, it can extract the ambient noise around the speaker unit precisely, and performs a natural compensation to the masking.

BRIEF DESCRIPTION OF THE DRAWINGS

25 FIG. 1 shows block diagram of a sound reproduction apparatus in an example of the present invention.

FIG. 2 is an output characteristic of a second microphone in the sound reproduction apparatus of the present invention.

FIG. 3 is an output characteristic of a high-pass filter in the sound

reproduction apparatus of the present invention.

FIG. 4 is an output characteristic of a first microphone in the sound reproduction apparatus of the present invention.

FIG. 5 is an output characteristic of a low-pass filter in the sound reproduction apparatus of the present invention.

FIG. 6 shows block diagram of a conventional sound reproduction apparatus.

BEST MODE FOR CARRYING OUT THE INVENTION

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Example

FIG. 1 shows block diagram of a sound reproduction apparatus in an example of the present invention. Referring to FIG. 1, input signal supplied to an input terminal 10 is delivered to a variable gain controller 11, or control means, which is controlled by a signal generated in accordance with an ambient noise to be described later. Output of the variable gain controller 11 is delivered to a power amplifier 12, output signal of the power amplifier 12 is connected to a speaker unit 14 mounted on a baffle 13. Outside the dust cap of speaker unit 14, a first microphone 16 is provided for collecting sum of the signal radiated from speaker unit 14 and the ambient noise.

Inside the dust cap of speaker unit 14, a second microphone 17 is provided for collecting the signal in proportion to the sound radiation from speaker unit 14.

An output signal of the first microphone 16 after passing through a low-pass filter 18 and an output signal of the second microphone 17 after passing through a high-pass filter 19 are input together to an adder 20. Then, components of the signal radiated from the speaker unit 14 are removed, and only the noise components around the speaker unit 14

collected by the first microphone 16 can be extracted. Output of the adder 20, which being the noise components around speaker unit 14, is delivered to a rectifier 21, or conversion means, to be converted from AC signal to DC signal. By supplying output signal of the rectifier 21 to the variable gain controller 11, the gains are automatically varied in accordance with the ambient noise around the speaker unit 14. Thus the masking is compensated in a more natural way.

In the following, description is made on a practical example.

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FIG. 2 shows frequency and phase characteristics of output signal from the second microphone 17 relative to output signal of power amplifier 12. In FIG. 2, frequency at a phase characteristic 0° is 70Hz. A primary high-pass filter 19 of cut-off frequency 70Hz is set as a second filter for outputting a signal of certain specific pass band. Frequency and phase characteristic of output signal from the second microphone 17 after passing through the high-pass filter 19 are shown in FIG. 3. Frequency at the phase characteristic 0° is 95Hz.

FIG. 4 shows frequency and phase characteristic of output signal from the first microphone 16 in relation to the output signal of power amplifier 12. A primary low-pass filter 18 is set as a first filter outputting a signal of certain specific pass band so that phase characteristic is -180° at the frequency 95Hz. Frequency and phase characteristic of output signal from the first microphone 16 after passing through the primary low-pass filter 18 are shown in FIG. 5. As shown in FIG. 3 and FIG. 5, output signals from the first microphone 16 and the second microphone 17 have approximately the same band pass characteristic in the frequency and the phase characteristic, with the phase inverse to each other. By inputting these signals to the adder 20, signal components radiated from the speaker

unit 14 are removed, only the noise components around the speaker unit 14 collected by the first microphone 16 can be extracted.

Although the first microphone 16 is provided somewhere outside the dust cap 15 in the present example, it may be attached and fixed instead on the outer surface of the dust cap 15. The latter configuration, which does not require any place for installing the first microphone 16 outside the speaker unit 14, reveals its advantageous in a case where a space available for installing the speaker unit 14 is limited. Also, the first microphone 16 may be provided somewhere opposing to the dust cap 15 with a certain predetermined clearance in between. In this case, signals reproduced by the speaker unit 14 and ambient noise may be collected together with a higher fidelity. Thus, the accuracy of extracting the noise components is improved for compensation of the masking.

Although the second microphone 17 is provided somewhere inside the dust cap 15 in the present example, it may be attached and fixed instead on the inner surface of the dust cap 15. The latter configuration, in which the place of second microphone 17 can be away from the inside of the speaker unit 14 where the temperature goes high during operation, is advantageous in that the second microphone 17 is protected from damage due to the heat. Also, the second microphone 17 may be provided opposing to the dust cap 15 with a certain predetermined clearance in between. In this case, signals reproduced by the speaker unit 14 may be collected with a higher fidelity. Thus, the accuracy of extracting the noise components is improved for compensation of the masking.

In the present example, the first microphone 16 and the second microphone 17 have been disposed, respectively, at the outside and at the inside of the dust cap 15. These microphones may be disposed instead on the axial line of the dust cap 15 opposing face to face with the dust cap 15 in the middle. In the above-described configuration, the first microphone 16

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collects the signals reproduced by the speaker unit 14 containing the ambient noise, while the second microphone 17 collects the reproduced sound of the speaker unit 14 within the dust cap 15 at an improved accuracy without ill-affecting the sound quality of speaker unit 14 at all. It is 5 advantageous in terms of the quality of reproduced sound and the accuracy of extracting the noise components. Thus, it leads to a higher accuracy in compensating the audio sound masking.

INDUSTRIAL APPLICABILITY

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Output signals from the two microphones, disposed respectively at the outside and the inside of dust cap, are processed through filters for precisely extracting only the ambient noise around the speaker unit, with the signal components output from the speaker unit removed. The noise 15 signal is converted by an rectifier circuit into DC component, and supplied to a variable gain control circuit provided at the input stage for automatically varying the gains in accordance with the ambient noise around the speaker unit. Thus the sound reproduction apparatus of the present invention provides reproduced sound that is not masked by the 20 ambient noise.

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CLAIMS

1. A sound reproduction apparatus comprising:
 - a power amplifier for amplifying input signal;
 - a speaker unit for reproducing output signal of the power amplifier,

5 mounted on a baffle;

- a first microphone provided outside a dust cap of speaker unit;
- a second microphone provided inside the dust cap of speaker unit;
- a first filter that receives output signal of said first microphone containing ambient noise and reproduced signal of said speaker unit, and

10 outputs a signal of certain specific pass band;

a second filter that receives output signal of said second microphone, and outputs a signal of certain specific pass band;

an adder for adding output signals from said first filter and said second filter;

15 conversion means for converting AC signal from the adder into DC signal; and

control means provided at the input stage of said power amplifier, said control means automatically controlling the strength of said input signal in accordance with DC signal delivered from said conversion means

20 so that the sound reproduced by said speaker unit is not masked by ambient noise around said speaker unit.

2. The sound reproduction apparatus of claim 1, wherein the first filter is a primary low-pass filter.

25

3. The sound reproduction apparatus recited in claim 1 or claim 2, wherein the second filter is a primary high-pass filter.

4. The sound reproduction apparatus of claim 1, wherein the first

microphone is attached and fixed on a outer surface of the dust cap.

5. The sound reproduction apparatus of claim 1, wherein the second microphone is attached and fixed on a inner surface of the dust cap.

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6. The sound reproduction apparatus of claim 1, wherein the first microphone is disposed opposing to the dust cap with a certain predetermined clearance.

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7. The sound reproduction apparatus of claim 1, wherein the second microphone is disposed opposing to the dust cap with a certain predetermined clearance.

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8. The sound reproduction apparatus of claim 1, wherein the first microphone and the second microphone are disposed on the axial line of the dust cap opposing face to face with the dust cap in the middle.

9. The sound reproduction apparatus of claim 1, wherein the conversion means is a rectifier circuit.

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10. The sound reproduction apparatus of claim 1, wherein the control means is a variable gain controller which controls an amplification degree of the input signal in accordance with the DC signal delivered from the conversion means.

TELETYPE REGISTERED TRADE MARK

ABSTRACT

A sound reproduction apparatus that performs a better masking compensation, by precisely extracting the ambient noise from a composite sound which contains the ambient noise and the signal generated by a speaker, removing therefrom the signal generated from the speaker. It comprises a first microphone (16) provided outside a dust cap (15) of a speaker unit (14), and a second microphone (17) provided inside a dust cap (15). An output signals from the microphones are filtered respectively and then added together, the added signal controls the strength of input signal.

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FIG. 1

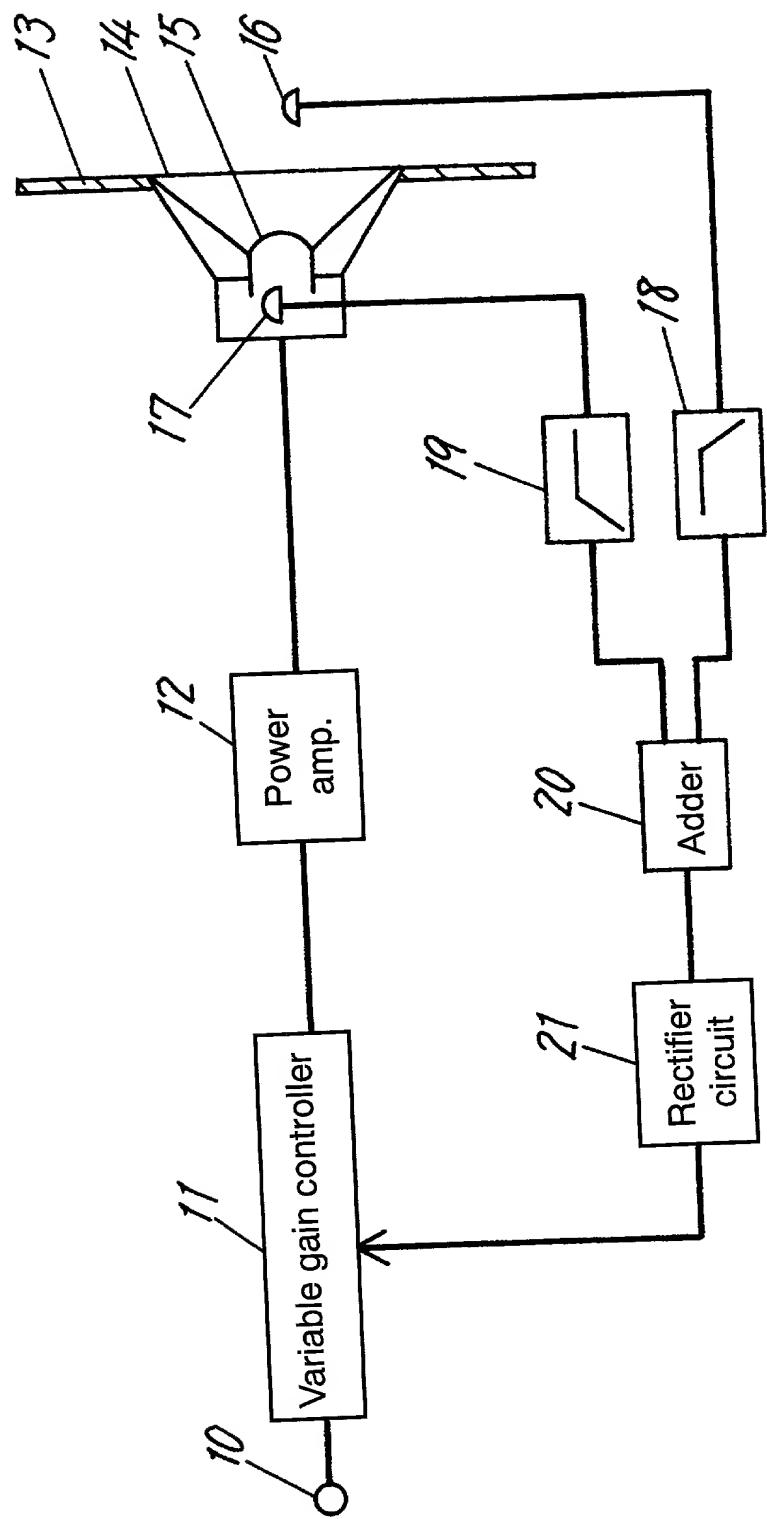
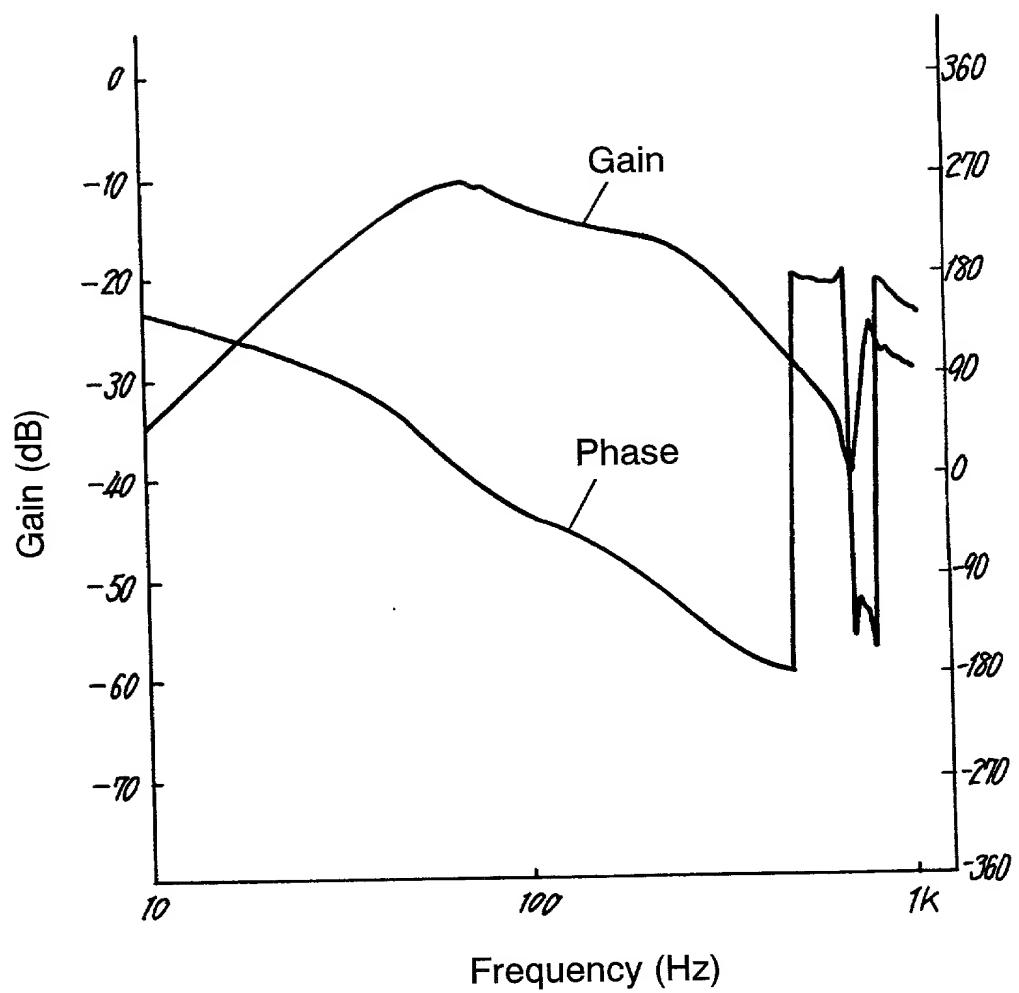


FIG. 2



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FIG.3

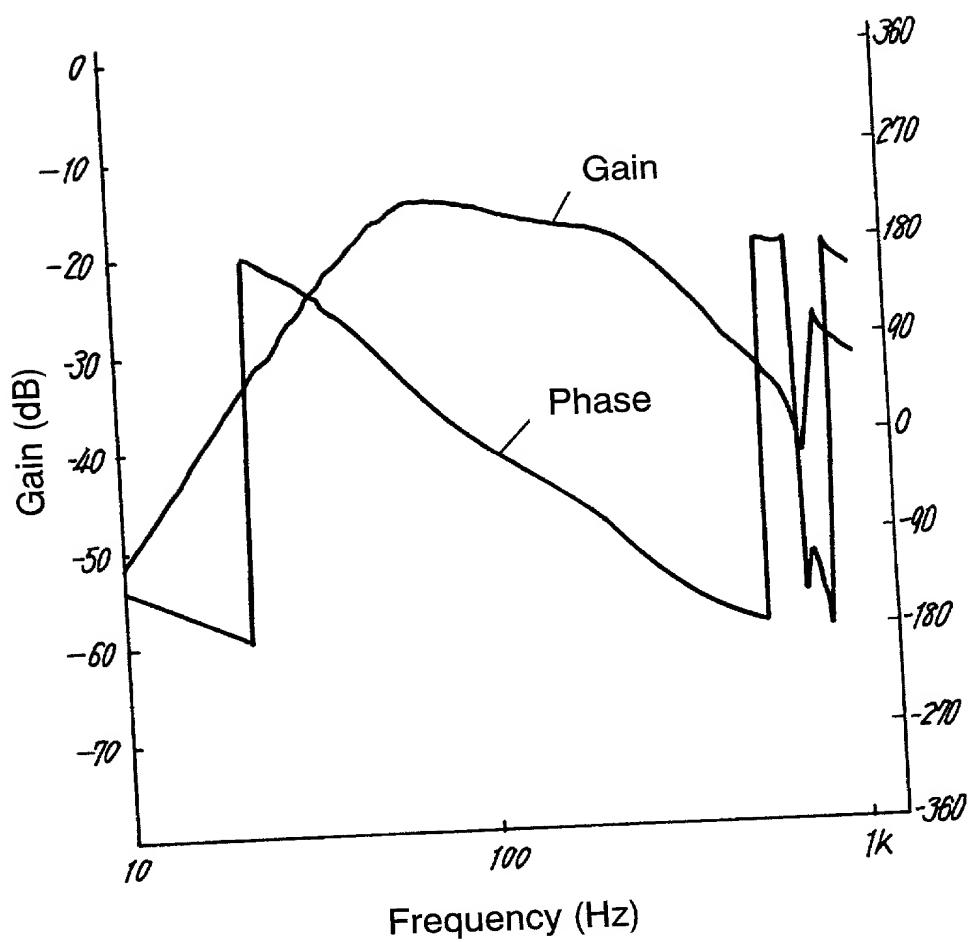
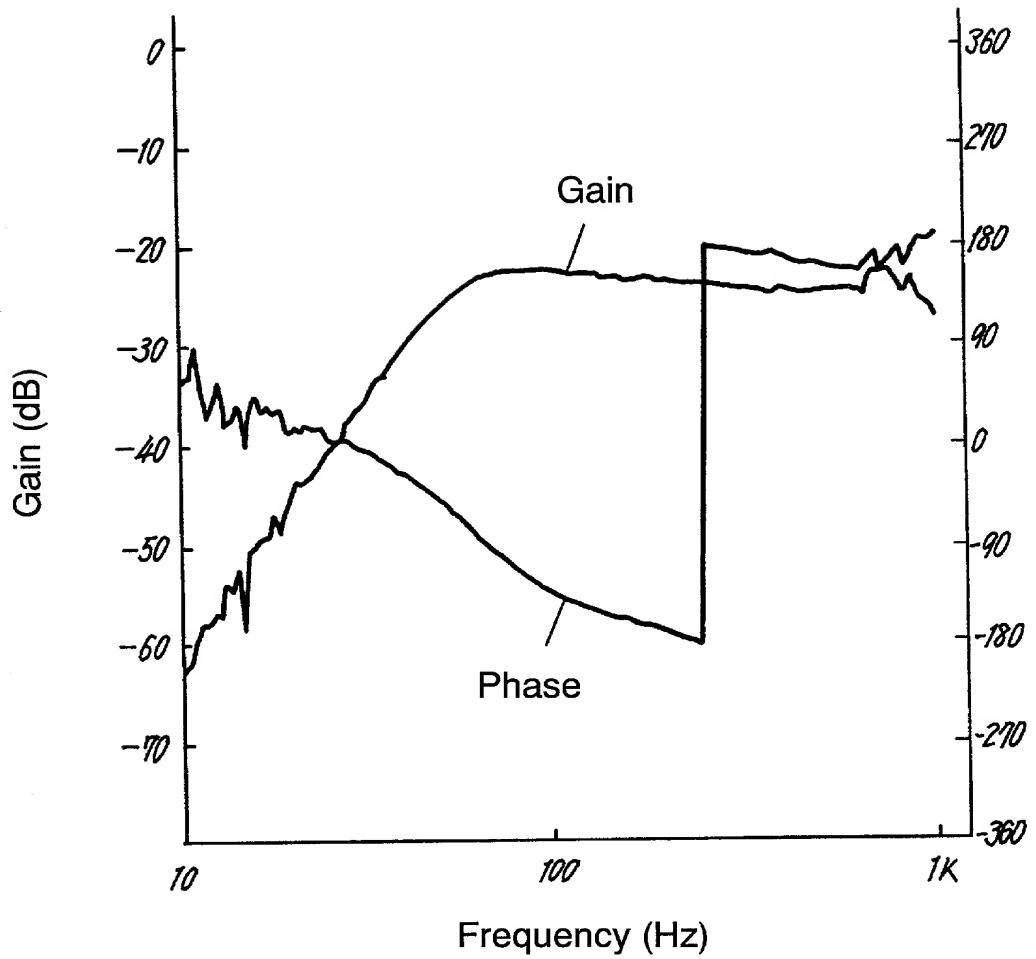


FIG. 4



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FIG. 5

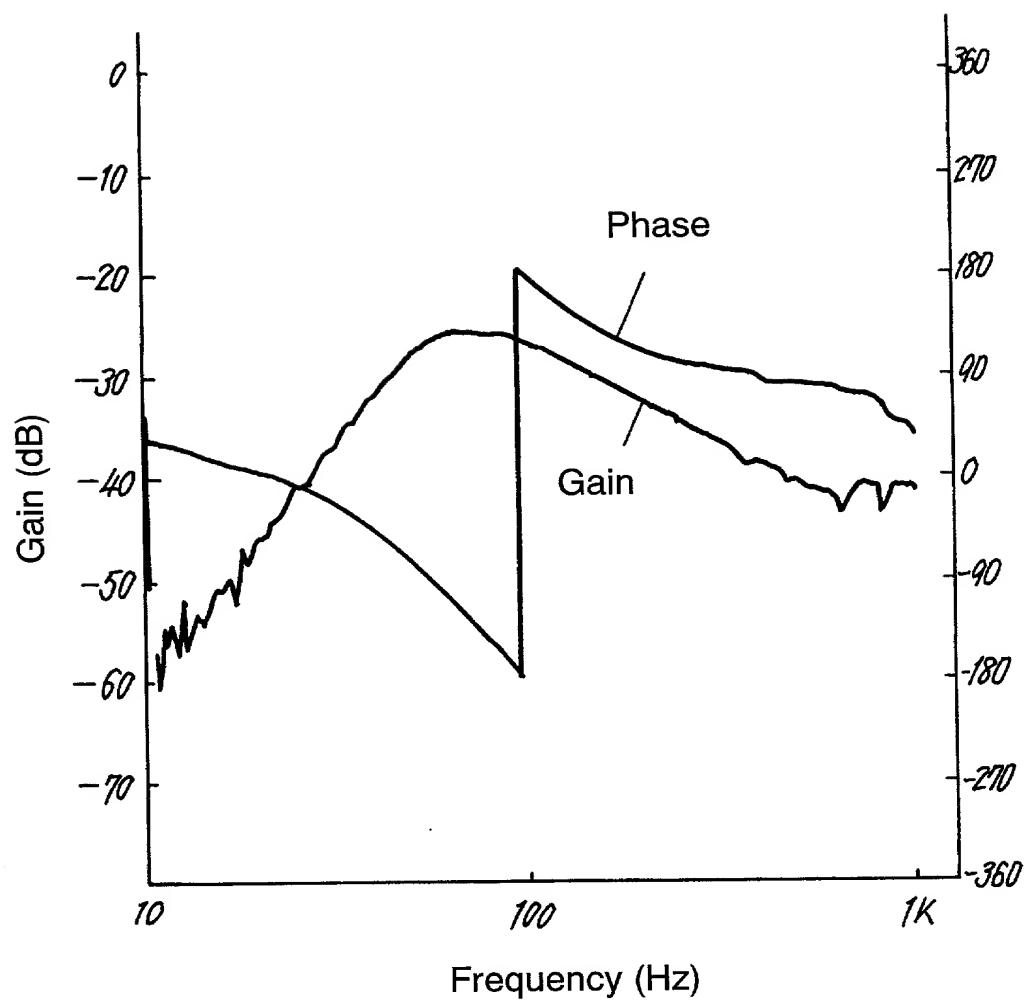
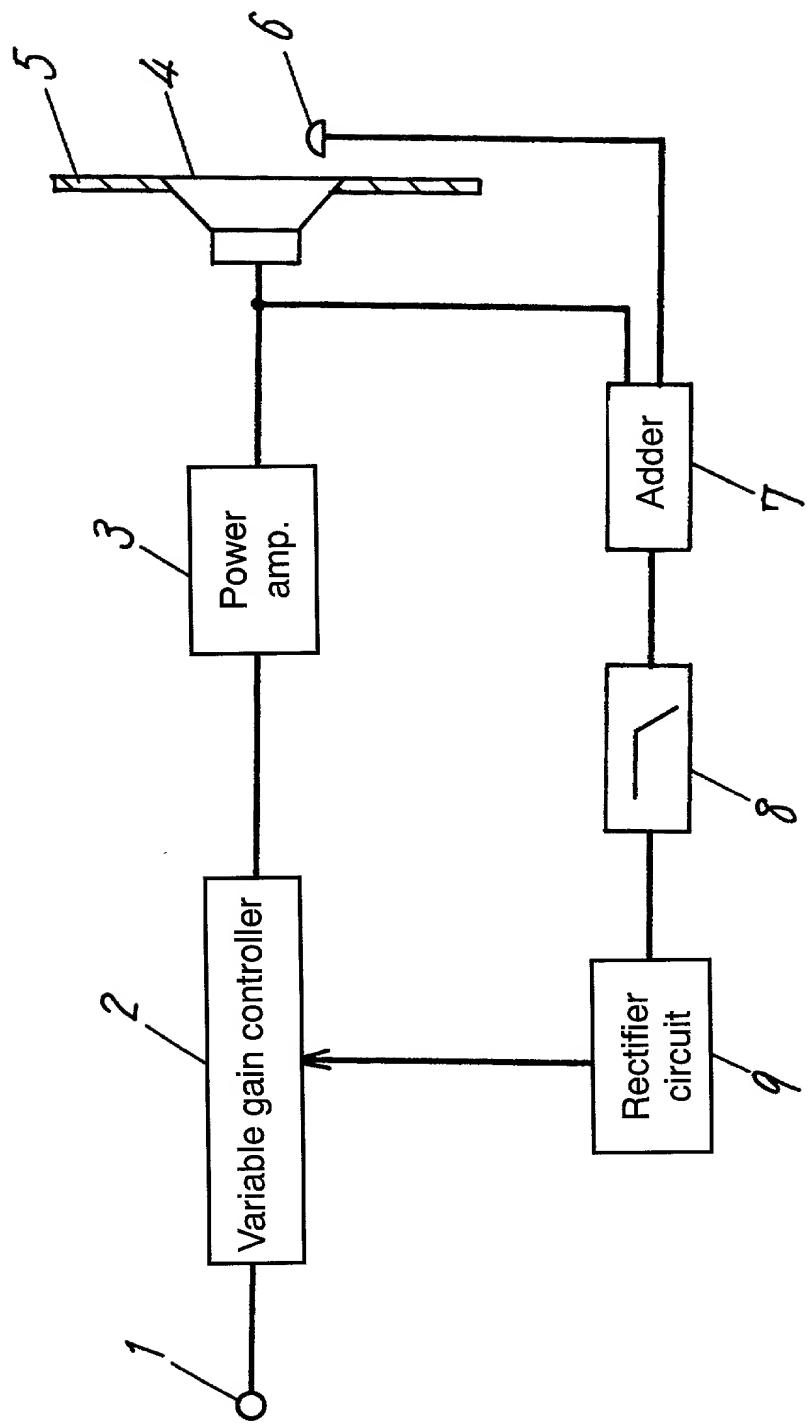


FIG. 6



Reference Numerals

- 10 input terminal
- 11 variable gain amplifier
- 12 power amplifier
- 13 baffle
- 14 speaker unit
- 15 dust cap
- 16 first microphone
- 17 second microphone
- 18 low pass filter
- 19 high pass filter
- 20 adder
- 21 rectifier circuit

DECLARATION AND POWER OF ATTORNEY FOR U.S. PATENT APPLICATION

Original Supplemental Substitute PCT DESIGN

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that I verily believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Title: SOUND REPRODUCTION APPARATUS

of which is described and claimed in:

the attached specification, or 09/786,990
 the specification in application Serial No. _____, filed March 13, 2001, and with amendments through the Preliminary Amendment on March 13, 2001
 the specification in International Application No. PCT/JP00/04652, filed July 12, 2000, and as amended on (if applicable).

I hereby state that I have reviewed and understand the content of the above-identified specification, including the claims, as amended by any amendment(s) referred to above.

I acknowledge my duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim priority benefits under Title 35, United States Code, §119 (and §172 if this application is for a Design) of any application(s) for patent or inventor's certificate listed below and have also identified below any application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NO.	DATE OF FILING	PRIORITY CLAIMED
Japan	11-203074	July 16, 1999	YES

I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose information material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION SERIAL NO.	U.S. FILING DATE	STATUS: PATENTED, PENDING, ABANDONED

And I hereby appoint Michael R. Davis, Reg. No. 25,134; Matthew M. Jacob, Reg. No. 25,154; Warren M. Cheek, Jr., Reg. No. 33,367; Nils Pedersen, Reg. No. 33,145; Charles R. Watts, Reg. No. 33,142; and Michael S. Huppert, Reg. No. 40,268, who together constitute the firm of WENDEROTH, LIND & PONACK, L.L.P., as well as any other attorneys and agents associated with Customer No. 000513, to prosecute this application and to transact all business in the U.S. Patent and Trademark Office connected therewith.

I hereby authorize the U.S. attorneys and agents named herein to accept and follow instructions from Matsushita Technical Information Services Co., Ltd. as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. attorneys and myself. In the event of a change in the persons from whom instructions may be taken, the U.S. attorneys named herein will be so notified by me.

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Post Office Address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE
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Residence & Citizenship	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP	
Post Office Address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE
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Residence & Citizenship	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP	
Post Office Address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE

Full Name of Sixth Inventor	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
Residence & Citizenship	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP
Post Office Address	ADDRESS	CITY	STATE OR COUNTRY ZIP CODE

I further declare that all statements made herein of my own knowledge are true, and that all statements on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

1st Inventor Masahide Onishi Date May 7, 2001
 Masahide ONISHI

2nd Inventor Fumiyasu Konno Date May 7, 2001
 Fumiyasu KONNO

3rd Inventor _____ Date _____

4th Inventor _____ Date _____

5th Inventor _____ Date _____

6th Inventor _____ Date _____

The above application may be more particularly identified as follows:

U.S. Application Serial No. 09/786,990 Filing Date March 13, 2001

Applicant Reference Number P23393-01 (I.S. Hasegawa) Atty Docket No. 2001_0219A

Title of Invention SOUND REPRODUCTION APPARATUS